

WHAT IS CLAIMED IS

1. A process for recovering in value the hydrogen-based gaseous effluents resulting from at least two reaction units R1 and R2 in which hydrogen is consumed, the unit R2 producing a hydrogen-rich gaseous effluent (6) at a pressure P and optionally a hydrogen-poor gaseous effluent (7) and the unit R1 producing at least one hydrogen-poor gaseous effluent (4, 5), characterized in that the following stages are carried out:
- during stage a), all the hydrogen-poor gaseous effluents (5, 4, 7) resulting from R1 and optionally from R2 are mixed so that the mixture obtained exhibits a pressure P,
  - during stage b), the mixture of all the hydrogen-poor gaseous effluents (5, 4, 7) resulting from R1 and optionally from R2, adjusted to the pressure P during stage a), is treated in a gas separation unit U fed with the hydrogen-rich gaseous effluent (6) resulting from the unit R2 so as to provide, at a first outlet, an enriched stream (9) exhibiting a greater hydrogen concentration than that of the hydrogen-rich gaseous effluent (6) resulting from the unit R2 and, at a second outlet, a waste stream (10),
  - during stage c), the enriched stream (9) resulting from the first outlet of the unit U is reinjected into a reaction unit R3 in which hydrogen is consumed.
2. The process as claimed in claim 1, characterized in that the hydrogen-rich effluent resulting from the unit R2 (6) exhibits a pressure of at least 5 bar.

3. The process as claimed in either of the preceding claims, characterized in that the hydrogen-rich effluent resulting from the unit R2 (6) exhibits a pressure of at least 15 bar.
- 5 4. The process as claimed in one of the preceding claims, characterized in that the hydrogen-rich effluent resulting from the unit R2 (6) exhibits a hydrogen concentration of between 50 and 99% by volume.
- 10 5. The process as claimed in one of the preceding claims, characterized in that the hydrogen-poor gaseous effluents (4, 5, 7) resulting from R1 and optionally from R2 exhibit a hydrogen concentration which is lower by least 10% with respect to the value of the hydrogen concentration of the hydrogen-rich effluent.
- 15 6. The process as claimed in one of the preceding claims, characterized in that the reaction unit R3 in which hydrogen is consumed is the reaction unit R2.
- 20 7. The process as claimed in one of the preceding claims, characterized in that the gas separation unit (U) is of the adsorption type.
- 25 8. The process as claimed in the preceding claim, characterized in that the gas separation unit (U) is a pressure swing adsorption (PSA) unit in combination with an incorporated compressor in which use is made, for each adsorber of the unit, of a pressure swing cycle comprising a sequence of phases which define adsorption, depressurization, purge and repressurization phases, such that:  
30 - during the adsorption phase:
  - during a first stage, the hydrogen-rich gaseous effluent (6) exhibiting a pressure P
- 35

resulting from the unit R2 is brought into contact with the bed of the adsorber, and

- during a second stage, the mixture with a pressure P composed:

- 5 • on the one hand, of the mixture of all the hydrogen-poor gaseous effluents (5, 4, 7) resulting from R1 and optionally from R2 adjusted to the pressure P during stage a), and

- 10 • on the other hand, of the recycle gas from the PSA,  
is introduced into contact with the bed of the adsorber,

so as to adsorb the compounds other than  
15 hydrogen and to produce, at the head of the bed of the adsorber, the enriched stream exhibiting a greater hydrogen concentration than that of the hydrogen-rich gaseous effluent (6) resulting from the unit R2,

- 20 - during the depressurization phase, the waste stream (10) from the PSA is produced,

- during the purge phase, a purge gas is produced,

- 25 - and where the recycle gas from the PSA is either the waste stream (10) compressed to the pressure P or the purge gas compressed to the pressure P.

9. The process as claimed in one of claims 1 to 5 and  
30 7 or 8, characterized in that the unit R1 is the unit for the hydrogenation of benzene of the synthesis of cyclohexane, the unit R2 is the unit for the hydrogenation of phenol of the synthesis of  $\epsilon$ -caprolactam and R3 is the unit for the  
35 synthesis of a hydroxylamine.

10. The process as claimed in either of claims 6 and 7 or 8, characterized in that it comprises two reaction units R1, one being a unit for the

hydrodealkylation of toluene of benzene and the other a unit for the production of cyclohexane, and the unit R2 is a unit for the hydrodisproportionation of xylenes or toluene.